



## TELECOMMUTING

### I. DESCRIPTION

Telecommuting is an approach for reducing home-to-work trips by allowing employees to work-at-home. Employees may be linked to the work place by computer and modem, or simply may take work home requiring no computer. Telecommuting employees usually work at home one or more days per week. Related options include employees working at satellite work centers (run by single employers) or neighborhood work centers (run by multiple employers). The centers usually are equipped with computers and modems and connected to a main office.

Telecommuting is a growing phenomenon. There are about 4 million telecommuters in the United States, a figure that has grown about 20 percent per year since 1988. The growth trend is spurred by the nature of the economy and by technology advances. In 1950, only 17 percent of U.S. workers were in information or service businesses such as sales, public relations, personnel, banking, health care and publishing. By 1980, over 50 percent of workers held information and service related positions.

With proper equipment, many functions associated with these positions can be done from the home or remote locations. Laptop or personal computers can be used to dial into host computers to retrieve information, update files and relay products. Recently, AT&T announced software for automatic call distributors allowing companies to route incoming calls and data to customer service agents working at home, allowing companies to recruit agents who need to stay at home to care for a small child or elderly person. For telecommuters geographically dispersed, companies can arrange to provide dial-up or virtual services. For telecommuters concentrated in a single locale, companies can lease a dedicated line to a central neighborhood center.

There still are some technological barriers. There is no easy way to tie a telecommuter into a company's electronic mail and voice mail systems. Forwarding calls to another employee if the telecommuter isn't home also is a problem.<sup>1</sup>

Because the strategy is new, it is difficult to estimate potential benefits. Much depends on future growth of telecommuting, the mix of industries in the future and unforeseen technology advances. One forecast estimates 23 billion could be saved annually in transportation, environmental and energy costs if there is a 10 to 20 percent increase in activities done through telecommuting instead of through physical transportation.<sup>2</sup>

### II. EFFECTS

Telecommuting potentially effects employers, employees and employee household members. Telecommuters may make fewer work trips or fewer and shorter trips, depending on whether they telecommute from home or from a satellite work center.

Telecommuting also may influence mode choice. Telecommuters may switch from solo driving to walking, cycling or transit to access neighborhood or satellite centers closer to home than their main office. Or, they may switch from carpools and transit to solo driving, cycling or transit.

Telecommuting may affect non-work trips. For instance, telecommuters or their family members may make more shopping trips as a result of having flexibility in work time or a vehicle at home normally parked at work. Telecommuting also may effect commuter decisions about where to live.

#### Work Trips

Examples of telecommuting suggest significant reductions in work trip vehicle miles:

- In a test among employees at the Southern California Association of Governments (SCAG), Telecommuting reduced person trip miles due to work trips avoided and shorter trips to satellite



centers. The net person trip reduction was 46 miles for each telecommute occasion. Allowing for the usual mode of travel for telecommuters (solo, rideshare, transit, etc.), 31 vehicle miles of travel were saved per telecommute. Fourteen percent of employees at the agency participated in the experiment beginning in June, 1986. Average participation was once every nine days. Most worked from home. One worked at a satellite work center. Not only were travel impacts positive, but impacts on productivity were positive. Management raised few concerns about lack of availability for meetings and communication with staff.<sup>3</sup>

- In preliminary findings among State of California telecommuters, work trip rates decreased 30 percent from .9 trips per day to .63, compared to a control group where work trip rates did not change. In the project, workers telecommuted one to two days per week. The project involved over 400 State employees across 13 agencies, including both treatment and controls. Travel diaries were used to track travel impacts.<sup>4</sup>
- A recent evaluation of the State of Hawaii satellite telecommute demonstration project found 93 percent of employees reported a reduced number of work trips and an average drop in fuel consumed of 29 percent (from 18 to 12.7 gallons). Travel time savings were 7.4 hours per week, or 385 hours per year. In the experiment, the Hawaii State Department of Transportation established a telework center in Mililani, Oahu, located twenty miles from downtown Honolulu. Seventeen employees, seven from six different Hawaii state agencies and ten from five private sector companies participated in the experiment.<sup>5</sup>

### Non-Work Trips

Effects on non-work trips are mixed, but not so negative as to outweigh work trip reductions:

- The study cited of SCAG employees shows some increase in non-work trips due to telecommuting. Under worst case assumptions, the vehicle miles

created were 14 percent of the miles saved. Thus, instead of 31 miles of travel saved per telecommute, only 26 miles were saved.

- Preliminary findings from the study of California state employees involved in telecommuting showed no increase in non-work trips by telecommuters compared to controls.<sup>6</sup> Furthermore, there was a reduction in non-work trips for other household members. Person trips per day for non-work trips fell from 3.6 to 2.3, a 35 percent drop. In this one experiment, it seems telecommuting favorably influenced overall household trip making.

### Mode of Travel

There is no information yet on telecommuting effecting mode of travel. In the study of SCAG employees, 19 percent shared a ride before telecommuting. Depending on the number of carpoolers switching to telecommuting, carpools may simply rearrange, continue with less occupancy or terminate (either temporarily or permanently).

### Other Effects

Telecommuting is an important element of employer demand management programs. Not only can the strategy reduce the number of work trips for those working at home and or their length for those working at satellite centers, it may dovetail with other employer objectives including improved morale and productivity. For example, in a pilot project at AT&T and state agencies in Phoenix, 80 percent of supervisors of telecommuters said telecommuting increased employee productivity; 76 percent said telecommuting improved employee morale; 90 percent said the telecommuting program should be expanded.<sup>7</sup> In a State of Hawaii pilot program discussed under examples, 80 percent of telecommuters reported an increase in work productivity. The majority of supervisors said productivity increased.

Another possible effect of telecommuting is on residential location. It is conceivable telecommuting might encourage program participants to locate further from work than they would without telecommuting programs.



In the State of California project referenced above, six percent of the telecommuters indicated moving or considering moving 45 or more miles from work since beginning to telecommute. Of these movers or potential movers, 28 percent reported telecommuting played a significant or decisive role in their considerations to move.<sup>8</sup> However, there was no difference in the actual moves of the telecommuters compared to a control group during the California test. The question remains what might be the effects over the long term.

### In Sum

The examples suggest significant travel and traffic impacts from telecommuting. Generally, the main potential impacts include:

- Reduced vehicle work trips in the case of home work, and reduced vehicle trips or trip lengths in the case of satellite centers.
- Potential increase in non-work trips, though evidence to date suggests no increases or small increases in such trips compared to decreased work trips.
- Possible changes in mode of travel for work trips, whether from solo driving to walking and cycling for satellite centers, or from carpooling and transit to solo driving for home based telecommuting.
- Possible changes in residential location, though evidence to date on this issue is scanty.

Of course the specific traffic impacts of trip reduction due to telecommuting depend on the location of main offices, home and satellite work sites. The impacts also depend on how often and what week days workers telecommute.

In the best case, telecommuter work trips are removed from congested highways and arterials leading to and from main offices. No work trips are made on the telecommute day, or any work trips to satellite centers are made on uncongested roads. And, telecommuting takes place several days per week.

In the worst case, telecommuting removes work trips from roads not congested, or breaks up carpools, or occurs only on days (e.g. fridays or mondays) when traffic is at its lightest, or adds work trips to satellite centers along congested roads. Only careful assessment and continuous evaluation in each work setting will determine the degree to which the best and worst cases apply.

## III. IMPLEMENTATION

### Applicability

The prospects for telecommuting depend on the setting in which it is applied. Important considerations include the type of employer work force and characteristics of the industry. Information industries such as accounting, data processing, programming and engineering design are more amenable to telecommuting than production lines, construction or sales.

At Pacific Bell, for example, a pioneer in telecommuting, most of the 2,000 telecommuters are financial specialists who gather and analyze lots of data.<sup>9</sup> Other examples:

- Heights Information Technology Service subcontracts work to data processing professionals who work at home full or part time
- Blue Cross employs 16 data entry personnel who work at home
- Control Data uses 100 full or part time computer programmers working from homes
- Hughes Aircraft set up a satellite office away from its main plant for artificial intelligence experts to work.<sup>10</sup>

In todays workforce of information workers, telecommuting may have significant application. One study suggests 16 percent of VMT for all trips now may be amenable to telecommunications. Another finds 40 percent of all work trips may be substituted.<sup>11</sup>



Also important to the application of telecommuting are employer policies. The number of employees eligible to participate in a telecommuting program, the extent of encouragement to participate, and which days telecommuting is allowed, all affect the potential application of the strategy.

Because telecommuting is a very new demand management strategy, its first application may be as a pilot project. For example, state governments in California, Washington and Hawaii are testing telecommunications within certain agencies and departments. The federal Office of Personnel Management has started a pilot program projected to involve 30 federal agencies around the U.S. Once proven to the satisfaction of management, the governments will develop new work hour and work at home policies to encourage and formalize telecommuting within agencies.

Telecommuting has potential application in urban, rural and suburban settings. Unlike other demand management strategies, the success of home based telecommuting is not dependent on the quality of alternative modes. Thus, the strategy has application even where transit or rideshare services are not substantial.

### Regulation, Pilots, Agreements

There are a variety of ways localities encourage implementation of telecommuting. Some of the options include:

- Incorporate telecommuting in trip reduction ordinances, air quality regulations and any legislation pertaining to demand management at employment sites. Sometimes trip reduction ordinances specify goals only in terms of increasing average vehicle ridership. Such goals will not encourage telecommuting unless specific credits are developed for telecommuters. A better goal for purposes of encouraging telecommuting is overall trip reduction measured across a typical week. This goal insures reduced trip making on the part of telecommuters is counted toward the ordinance or regulation goal.

- Demonstrations in both the public and private sector. Telecommuting is still a relatively new demand management strategy. Most states and local governments begin telecommuting through carefully evaluated pilot programs. If a joint public-private program is launched, the private sector may not only join in the demonstration, but donate equipment and services, especially for satellite centers. This was the case in the Hawaii demonstration discussed above.
- Model employee-employer agreements to deal with barriers. Such models can alleviate concerns about equipment liability, theft or damage and eligibility for worker's compensation.
- Agreements with union and labor groups. The AFL-CIO in 1983 passed a resolution calling for the Department of Labor to ban computer homework except for the handicapped. The Service Employees International Union banned telecommuting in 1982 for its clerical and health care workers. Agreements sometimes are needed to overcome union concerns about benefits for work at home employees.
- Modification of local zoning codes which prohibit or discourage work at home arrangements. Some of these laws arose in the 1940's out of concern for "sweatshops" and "cottage industries."<sup>12</sup>

### Planning and Policy Considerations

Implementation of telecommuting requires considerable attention to program design. Key program elements include:

- Voluntary telecommuting arrangement between supervisor and employee, not an entitlement or employee benefit. Either party may terminate the arrangement with



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- Job performance measured by results under clearly defined tasks and deliverables.
- Telecommuter agreement to secure proprietary information if working at home.
- Specific agreement between the employer and telecommuter on ownership and use of equipment. One option is for the company to provide the equipment (e.g. computer, modem, printer, access line) and retain all ownership rights to it. Another is for the employee to use his or her own equipment and receive some compensation. In any case, costs for employee business calls must be compensated.
- Utility cost sharing arrangements. Most telecommute programs do not compensate employees for any additional utility expenses associated with work at home. Employers and employees need to address and negotiate this issue. The usual rationale for not compensating these expenses is that the benefits of working at home offset the incremental increase in utility costs.
- Telecommuter coverage under Workers' Compensation for job related accidents occurring when the employee is working at home. Employees work in a designated work space free from hazards. The employer, with reasonable notice, may make on-site visits to determine the site is safe.
- Liability assignment. Usually, the employee remains liable for injuries to third parties and or members of the employee's family on the employees premises.
- Clear understanding of tax implications relating to the home work space. Generally, IRS allows a deduction for home offices provided the employees use is for the convenience of the employer. It is not necessary that the employer require work at home as a condition of employment. However, the designated place of work must be used exclusively for work purposes.

- All arrangements spelled out in a Telecommuting Agreement. Any violation of the rules may result in termination of the telecommuting arrangement.

### Cost Benefit Considerations

Costs and benefits of telecommuting can be estimated. The costs of telecommuting include personnel training, telecommunications installation and operating charges, computer and/or modem purchase and maintenance, possible furniture purchase, insurance and the administrative costs of administering a program.



Telecommuting costs may also include an increase in heating, ventilation and cooling at telecommuter households. There also may be indirect costs associated with less availability of employees for meetings on short notice, the need for changes in managerial style and new procedures insuring data security. Some of these costs are borne by the employer and some are not. For example, some employers provide personal computers for their telecommuters while others do not.

Studies address these costs. One study of costs and benefits of telecommuting for 500 City of Los Angeles employees estimates two year demonstration costs at \$970,000, including additional phone charges, administrative costs, and new equipment and software. Cost per year per participant therefore are \$970, presuming equipment costs are allocated over two years instead of amortized over a longer period. Indirect costs were not estimated. Benefits in office space savings and improved employee productivity were estimated to exceed costs.<sup>13</sup> Another study estimates first year costs at \$533 per participant, declining to \$258 per year thereafter.<sup>14</sup> The study assumes no need for additional computers and no increase in building heating costs.

Obviously, cost estimates vary. Allowing for some amortized equipment costs and added utility costs, assume a steady state direct cost of \$350 per employee per year. Finally, there are indirect costs, as noted above, associated with less availability of employees for meetings on short notice, the need for changes in managerial style and new procedures insuring data security.



On the benefit side, assume indirect costs are balanced by the indirect benefits of decreased employee sick leave usage, decreased employee turnover, increased productivity and office space savings. This may be a conservative assumption, as these benefits were estimated not to balance but exceed many program costs (including administrative costs) in the City of Los Angeles study. Assuming indirect costs and benefits balance, we may estimate how direct costs compare with the benefits of reduced trips. At a cost of \$350 per participating employee per year, daily costs are \$1.34 based on 261 days per year. According to the State of California data, work trips per participating employee declined from .9 per day to .63, or .27 trips per day. Cost per unit trip reduced, then, is \$4.97. Presuming an average trip is 20 miles in length, and operating and maintenance costs are \$0.30 per mile, the investment of \$4.97 more than saves the o & m costs of \$6.00, let alone external costs of pollution and congestion.

### IV. FUTURE DIRECTIONS

Experience with telecommuting suggests it can be an effective strategy for reducing commuter traffic. However, home based and satellite strategies deserve careful planning, assessment and evaluation in future applications. Specific effectiveness and implementation issues deserve attention in future applications:

#### Effectiveness

- What types of employers and employees present the best prospects for wide adoption of the strategy?
- What participation rates can be expected in various industries and labor markets?
- In what situations and industries are home based and satellite forms of telecommuting most applicable?
- What effect does telecommuting have not just on work and non-work trip volumes, but mode of travel? In particular, what are impacts on carpools and transit ridership?

- What are mid and long term impacts on residential choice and location for telecommuters? If telecommuting encourages locating further from work, are the net effects of the telecommute program on overall VMTs still positive?

#### Implementation

- Telecommuting raise several implementation issues best addressed by feasibility assessments and detailed planning.
- What changes are needed in local codes prohibiting work at home? What are best model code terms and provisions?
- Under what local conditions are voluntary or regulatory means preferred to encourage variable work hours?
- What are good model employee and supervisor work agreements under work at home telecommuting? And model employer/employee agreements on utility cost sharing, data security and equipment and personal liability?
- What terms and policies would best clarify federal tax policy on home office deductions so to encourage telecommuting but discourage abuse and tax evasion? In particular, should "convenience of the employer" provisions be clarified or revised?
- What labor union agreements restrict employee hours or work at home programs, and what changes are feasible and useful to encouraging telecommuting?
- What assurances and evidence does management need to overcome uncertainty or resistance to telecommuting?





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### Footnotes

- <sup>1</sup> "Users Need to Adopt Telecommuting Plans," *Network World*, March 18, 1991.
- <sup>2</sup> *Network World*, Op. Cit.
- <sup>3</sup> *Evaluation Report, Telecommuting Pilot Project*, Southern California Association of Governments, August 1988.
- <sup>4</sup> "Telecommuting as a Transportation Planning Measure: Initial Results of State of California Pilot Project," R. Kitamura, et. al., a paper before the *Transportation Research Board, 69th Annual Meeting*, January, 1989.
- <sup>5</sup> *Evaluation of the Hawaii Telework Center Demonstration Project*, Department of Transportation, State of Hawaii, September, 1990.
- <sup>6</sup> Kitamura et al., 1989.
- <sup>7</sup> "Phoenix Telecommuting Project Doing Very Well," *Urban Transportation Monitor*, May 10, 1991.
- <sup>8</sup> Patricia Mokhtarian, "Telecommuting and Travel: State of the Practice, State of the Art," *Transportation*, 18, 1991.
- <sup>9</sup> *Network World*, Op. Cit.
- <sup>10</sup> *Telecommuting Phenomenon: Overview and Evaluation*, SCAG, March, 1985.
- <sup>11</sup> *The Telecommuting Phenomenon: Overview and Evaluation*, Op. Cit.
- <sup>12</sup> *The Telecommuting Phenomenon: Overview and Evaluation*, Op. Cit.
- <sup>13</sup> *Telecommunity*, "City of Los Angeles Telecommuting Project," Volume 5, No. 2, September/October, 1989, Southern California Association of Governments.

- <sup>14</sup> Jack Nilles, Walter Siembab, "Telecommuting and Vanpooling: Cost and Benefit Comparisons," unpublished paper submitted to *Transportation Journal*, June 1991.